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EXAMINER	
WEST, JEFFREY R	

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2857	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/808,499	MIYAIRI ET AL.	
	Examiner	Art Unit	
	Jeffrey R. West	2857	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 October 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *See Continuation Sheet* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *See Continuation Sheet* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *30 May 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Continuation of Disposition of Claims: Claims pending in the application are 1,3,11,18,26,28,32,34,37,39,42,44,45,47,50,52,53,55,58,60,69,71,74,76,77,79,82 and 86-89.

Continuation of Disposition of Claims: Claims rejected are 1,3,11,18,26,28,32,34,37,39,42,44,45,47,50,52,53,55,58,60,69,71,74,76,77,79,82 and 86-89.

DETAILED ACTION

1. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 3, 34, 39, 71, 79, and 87 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Application Publication No. 2003/0016349 to Tsumura et al. in view of U.S. Patent Application Publication No. 2002/0031249 to Komuro et al. and further in view of U.S. Patent Application Publication No. 2005/0041226 to Tanaka et al.

With respect to claim 3, Tsumura discloses a method for testing comprising irradiating a visible light on a surface of a semiconductor film (0027, lines 1-9), the semiconductor film having a crystallinity that has been improved by irradiating an energy beam (0063, lines 1-17); photo-transferring a scattered light of the irradiated visible light to form an image (0097, lines 1-16), analyzing regions of the image to discriminate regions of luminance (0091, lines 1-12) and comparing values of luminances with a reference value which is determined for a demanded performance of the semiconductor element in order to evaluate the crystallinity of the semiconductor film having the crystallinity that has been improved (0076, lines 1-12).

With respect to claim 34, Tsumura discloses wherein the energy beam is a laser light (0111, lines 1-4).

With respect to claim 39, Tsumura discloses wherein the visible light is irradiated from a light source selected from the group consisting of a metal halide lamp, a halogen lamp, a tungsten lamp, a xenon lamp, a light emitting diode, and a fluorescent lamp (i.e. halogen lamp) (0098, lines 1-13).

With respect to claim 71, Tsumura discloses a manufacturing method of a semiconductor device, comprising: testing each of a plurality of semiconductor films crystallized by the energy beam (0088, lines 1-11) set to different energy densities by the method for testing (0107, lines 1-6) and determining an irradiation energy density by a result of the testing to crystallize the semiconductor film (0107, lines 1-6 and 0110, line 1 to 0111, line 4).

Tsumura also discloses a method for testing a beam profile comprising irradiating an energy beam on a substrate on which an amorphous semiconductor film (0043, lines 1-5) is formed (0063, lines 1-17), irradiating a visible light on a surface of the substrate (0027, lines 1-9) and photo-transferring the scattered light to form an image (0097, lines 1-16), analyzing regions of the image to discriminate regions of luminance (0091, lines 1-12) to test a profile of the energy beam (0088, lines 1-11, 0107, lines 1-6, and 0110, line 1 to 0111, line 4) and comparing values of luminances with a reference value which is determined for a demanded performance of the semiconductor element in order to evaluate the crystallinity of the semiconductor film having the crystallinity that has been improved (0076, lines 1-12).

As noted above, the invention of Tsumura teaches many of the features of the claimed invention and while the invention of Tsumura does teach determining acceptance based on comparing values of luminances with a reference value which is determined for a demanded performance of the semiconductor element in order to evaluate the crystallinity of the semiconductor film having the crystallinity that has been improved wherein the determining is based on determining locations on the surface of the film on the basis of a histogram (0076, lines 1-12), and while Tsumura does specify that the beam source is set at an angle with respect to the perpendicular (0067, lines 1-7), Tsumura does not include the specifics on how the angle of the beam source is set.

Komuro teaches a defect detecting apparatus comprising irradiating a visible light on a surface of a semiconductor (0061, lines 1-12) to produce a digital image by

using a camera (0061, lines 4-8) to take a visible light dark field photograph (0087, lines 1-18), of a semiconductor film (0004, lines 1-5 and 0061, lines 4-8), wherein the visible light used for taking the dark field photograph of the semiconductor film is of an arbitrary wavelength provided it is visible (i.e. 600nm) (0188, lines 5-6) and calculating an average luminance of the digital image (0063, lines 1-20 and 0069, lines 1-11) by defining basic units consisting of m rows and n columns by dividing the digital image into n in the X direction and m in the Y direction in a predetermined analysis range (0092, lines 1-16 and 0149, lines 1-17), calculating/testing average values of luminances of the n basic units aligned in the X direction per each of the m rows aligned in the Y direction (0063, lines 1-20 and 0069, lines 1-11), obtaining an approximate line (i.e. graph) from relations between the positions in the Y direction and the average values of the luminance corresponding to the positions in the Y direction (Figure 4), and comparing a fluctuation obtained from relations between the approximate line and the average values of the luminance with a reference value which is determined for a demanded beam performance of a semiconductor element that would comprise the semiconductor film (i.e. compare the fluctuation of the graph to a maximum allowed luminance reference value) (0063, lines 1-20, 0069, lines 1-11, 0088, lines 1-25, and Figure 4).

It would have been obvious to one having ordinary skill in the art to modify the invention of Tsumura to include the specifics on how the angle of the beam source is set, as taught by Komuro, because Komuro suggests a corresponding method for setting the angle of the beam source applicable to the defect detection invention of

Tsumura, that would have improved the system of Tsumura by allowing setting of the beam source to an angle that will produce a desired luminance for crystallization, for example, a maximum luminance (0063, lines 1-20, 0069, lines 1-11, 0088, lines 1-25, and Figure 4).

As noted above, the invention of Tsumura and Komuro teaches many of the features of the claimed invention and while the invention of Tsumura and Komuro does teach calculating average values of the luminance corresponding to the positions in the Y direction of a surface scanned by an energy beam, the combination does not explicitly indicate that the measurement is to be performed in a direction perpendicular to the scanning direction of the light.

Tanaka teaches a method and device for exposure control comprising scanning reticle stage in an x-direction using a light source (0129, lines 1-13), receiving reflected light (0131, lines 1-7) and measuring a distribution of luminance (0321, lines 1-8) wherein the measurement is performed in a direction perpendicular to the scanning direction of the light (0322, lines 1-5).

It would have been obvious to one having ordinary skill in the art to modify the invention of Tsumura and Komuro to explicitly indicate that the measurement is to be performed in a direction perpendicular to the scanning direction of the light, as taught by Tanaka, because, as suggested by Tanaka, the combination would have improved the measurement of Tsumura and Komuro by canceling any irregularity of luminance measured in the scanning direction caused by the scanning itself (0322, lines 1-5).

With respect to claim 79, since the invention of Tsumura teaches performing testing by employing a plurality of components in a crystallization chamber/container (0060, lines 1-7) and the invention of Komuro teaches including a means for taking a visible light dark filed photograph of a semiconductor film as part of the components for testing, the combination would have provided a means for taking a visible light dark filed photograph of a semiconductor film in a crystallization chamber.

4. Claims 1, 11, 18, 32, 37, 69, 77, and 86 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsumura et al. in view of Komuro et al. and Tanaka et al. and further in view of U.S. Patent Application Publication No. 2004/0228526 to Lin et al.

As noted above, Tsumura in combination with Komuro and Tanaka teaches many of the features of the claimed invention and while the invention of Tsumura, Komuro, and Tanaka does teach measuring averages of luminance of an image to determine variations of a surface illuminated by a multi-color light source (Tsumura; 0098, lines 1-3), the combination does not specify determining a corrected saturation value for the image.

Lin teaches a system and method for color characterization using fuzzy pixel classification with application in color matching and color match location comprising means for inspecting a surface of an object (0003, lines 7-12) by dividing an image into regions of interest (0038, lines 1-12) and measuring a saturation value for the

image (0112, lines 1-15) that has been corrected/normalized to a range from 0 to 255 (0110, lines 8-11).

It would have been obvious to one having ordinary skill in the art to modify the invention of Tsumura, Komuro, and Tanaka to specify determining a corrected saturation value for the image, as taught by Lin, because the invention of Tsumura, Komuro, and Tanaka does teach measuring averages of luminance of an image to determine variations of a surface illuminated by a multi-color light source and Lin suggests a corresponding method that would have improved the inspection method of Tsumura, Komuro, and Tanaka by determining saturation values useful in inspecting colored surfaces, such as the surface colored by the multi-color light source of Tsumura, Komuro, and Tanaka, and provided increased accuracy in surface inspection by measuring saturation values that provide more information regarding color variations (0004, lines 1-10 and 0006, line 1 to 0007, line 8).

5. Claims 47 and 55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsumura et al. in view of Komuro et al. and Tanaka and further in view of U.S. Patent Application Publication No. 2003/0142298 to Ujihara et al.

As noted above, Tsumura in combination with Komuro and Tanaka teaches many of the features of the claimed invention and while the invention of Tsumura, Komuro, and Tanaka does teach applying a visible light to the surface of a semiconductor film which is used for taking a dark field photograph, the visible light

being the light from a halogen source, the combination does not specify the output of the halogen source.

Ujihara teaches an inspection method and inspection system of a surface of an article through the inspection of a photographed image of its surface (0002, lines 1-3) in order to determine the illumination variations of the surface, wherein the surface is illuminated by a light source (0009, lines 1-13) such as a halogen lamp with an intensity of 20,000 to 100,000 lux (0052, lines 1-9).

It would have been obvious to one having ordinary skill in the art to modify the invention of Tsumura, Komuro, and Tanaka to specify a corresponding output of the halogen source, as taught by Ujihara, because the combination of Tsumura, Komuro and Tanaka does teach implementing a halogen light source and Ujihara suggests a corresponding intensity range suitable for a halogen lamp to carry out the inspection of Tsumura, Komuro, and Tanaka (0052, lines 1-9).

6. Claims 45 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsumura et al. in view of Komuro et al. Tanaka, and Lin and further in view of U.S. Patent Application Publication No. 2003/0142298 to Ujihara et al.

As noted above, Tsumura in combination with Komuro, Tanaka, and Lin teaches many of the features of the claimed invention and while the invention of Tsumura, Komuro, Tanaka, and Lin does teach applying a visible light to the surface of a semiconductor film which is used for taking a dark field photograph, the visible light

being the light from a halogen source, the combination does not specify the output of the halogen source.

Ujihara teaches an inspection method and inspection system of a surface of an article through the inspection of a photographed image of its surface (0002, lines 1-3) in order to determine the illumination variations of the surface, wherein the surface is illuminated by a light source (0009, lines 1-13) such as a halogen lamp with an intensity of 20,000 to 100,000 lux (0052, lines 1-9).

It would have been obvious to one having ordinary skill in the art to modify the invention of Tsumura, Komuro, Tanaka, and Lin to specify a corresponding output of the halogen source, as taught by Ujihara, because the combination of Tsumura, Komuro, Tanaka, and Lin does teach implementing a halogen light source and Ujihara suggests a corresponding intensity range suitable for a halogen lamp to carry out the inspection of Tsumura, Komuro, Tanaka, and Lin (0052, lines 1-9).

7. Claims 28, 44, 76, and 89 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsumura et al. in view of Komuro et al. and Tanaka and further in view of U.S. Patent No. 6,861,614 to Tanabe et al.

As noted above, Tsumura in combination with Komuro and Tanaka teaches many of the features of the claimed invention and while the invention of Tsumura, Komuro, and Tanaka does teach a method for testing a beam profile by irradiating a laser energy beam on a substrate on which an amorphous semiconductor film is formed, the combination does not specify that the laser is applied as a pulse.

Tanabe teaches an S-System for the formation of a silicon thin film and a semiconductor-insulating film interface comprising performing laser-induced crystallization using a laser pulse (column 2, lines 1-14 and column 20, line 60 to column 21, line 10).

It would have been obvious to one having ordinary skill in the art to modify the invention of Tsumura, Komuro, and Tanaka to specify that the laser is applied as a pulse, as taught by Tanabe, because the combination, as suggested by Tanabe, would have provided a conventional method to enable one having ordinary skill in the art to carry out the crystallization improvement of Tsumura, Komuro, and Tanaka thereby providing results in accordance with convention (column 2, lines 1-14 and column 20, line 60 to column 21, line 10).

8. Claims 26, 42, 74, 82, and 88 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsumura et al. in view of Komuro et al., Tanaka, and Lin and further in view of U.S. Patent No. 6,861,614 to Tanabe et al.

As noted above, Tsumura in combination with Komuro, Tanaka, and Lin teaches many of the features of the claimed invention and while the invention of Tsumura, Komuro, Tanaka, and Lin does teach a method for testing a beam profile by irradiating a laser energy beam on a substrate on which an amorphous semiconductor film is formed, the combination does not specify that the laser is applied as a pulse.

Tanabe teaches an S-System for the formation of a silicon thin film and a semiconductor-insulating film interface comprising performing laser-induced crystallization using a laser pulse (column 2, lines 1-14 and column 20, line 60 to column 21, line 10).

It would have been obvious to one having ordinary skill in the art to modify the invention of Tsumura, Komuro, Tanaka, and Lin to specify that the laser is applied as a pulse, as taught by Tanabe, because the combination, as suggested by Tanabe, would have provided a conventional method to enable one having ordinary skill in the art to carry out the crystallization improvement of Tsumura, Komuro, Tanaka, and Lin thereby providing results in accordance with convention (column 2, lines 1-14 and column 20, line 60 to column 21, line 10).

9. Claims 52 and 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsumura et al. in view of Komuro et al., Tanaka, and Tanabe and further in view of U.S. Patent Application Publication No. 2003/0142298 to Ujihara et al.

As noted above, Tsumura in combination with Komuro, Tanaka, and Tanabe teaches many of the features of the claimed invention and while the invention of Tsumura, Komuro, Tanaka, and Tanabe does teach applying a visible light to the surface of a semiconductor film which is used for taking a dark field photograph, the visible light being the light from a halogen source, the combination does not specify the output of the halogen source.

Ujihara teaches an inspection method and inspection system of a surface of an article through the inspection of a photographed image of its surface (0002, lines 1-3) in order to determine the illumination variations of the surface, wherein the surface is illuminated by a light source (0009, lines 1-13) such as a halogen lamp with an intensity of 20,000 to 100,000 lux (0052, lines 1-9).

It would have been obvious to one having ordinary skill in the art to modify the invention of Tsumura, Komuro, Tanaka, and Tanabe to specify a corresponding output of the halogen source, as taught by Ujihara, because the combination of Tsumura, Komuro, Tanaka, and Tanabe does teach implementing a halogen light source and Ujihara suggests a corresponding intensity range suitable for a halogen lamp to carry out the inspection of Tsumura, Komuro, Tanaka, and Tanabe (0052, lines 1-9).

10. Claims 50 and 58 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsumura et al. in view of Komuro et al., Tanaka, Lin, and Tanabe and further in view of U.S. Patent Application Publication No. 2003/0142298 to Ujihara et al.

As noted above, Tsumura in combination with Komuro, Tanaka, Lin, and Tanabe teaches many of the features of the claimed invention and while the invention of Tsumura, Komuro, Tanaka, Lin, and Tanabe does teach applying a visible light to the surface of a semiconductor film which is used for taking a dark field photograph, the visible light being the light from a halogen source, the combination does not specify the output of the halogen source.

Ujihara teaches an inspection method and inspection system of a surface of an article through the inspection of a photographed image of its surface (0002, lines 1-3) in order to determine the illumination variations of the surface, wherein the surface is illuminated by a light source (0009, lines 1-13) such as a halogen lamp with an intensity of 20,000 to 100,000 lux (0052, lines 1-9).

It would have been obvious to one having ordinary skill in the art to modify the invention of Tsumura, Komuro, Tanaka, Lin, and Tanabe to specify a corresponding output of the halogen source, as taught by Ujihara, because the combination of Tsumura, Komuro, Tanaka, Lin, and Tanabe does teach implementing a halogen light source and Ujihara suggests a corresponding intensity range suitable for a halogen lamp to carry out the inspection of Tsumura, Komuro, Tanaka, Lin, and Tanabe (0052, lines 1-9).

Response to Arguments

11. Applicant's arguments filed October 20, 2010, have been fully considered but they are not persuasive.

Applicant argues:

> One key point of the present invention is that the present invention allows evaluation of crystalline characteristics of a semiconductor film in a very rapid and efficient way by (i) taking a simple dark-field photograph of a surface of a processed film (no scanning is necessary, an image of a surface of the film is almost instantaneously obtained, as in traditional photography) and (ii) performing a rather simple analysis of the photograph to check, for example, the presence of stripes perpendicular to the scanning direction Y of the laser used to process the film. The fluctuations of luminosity along the Y direction (studied through the "approximate line" method as noted in the present specification) reveal the presence of bright stripes. Please note that this method does <u>not</u>

require any specific light wavelength nor any specific incident angle of illumination (as illustrated in Figure 1 by the use of ring lighting that can be tilted at will).

The Applicant respectfully submits that the invention as described above is neither disclosed by nor obvious over the cited references, either alone or in combination. Further, the Applicant believes that the current claims are sufficient to distinguish the present invention over the prior art, which require, for example, using a plurality of precise wavelengths such as in Tsumura, or determining a precise angle such as in Komuro, as explained below.

The method of the present invention is particularly adapted to detect a crystalline quality of a semiconductor film having been submitted to a laser treatment leading to the appearance of bright stripes (visible in a dark-field photograph) in a specific direction, the X direction as defined and recited in the claims: "a direction in which the energy beam is scanned is a Y direction, and a direction perpendicular to the Y direction is an X direction in the digital image." For this reason, the basic m x n units definition and subsequent image analysis are performed in accordance with this specific direction. Please note that this allows for simplified image analysis, thus fast assessment of the quality of the film.

On the other hand, Tsumura discloses a method used to detect what seems to be random patterns (see Figure 10). As such, Tsumura's method cannot use the simplified analysis described in the claims, in particular, since no specific direction seems to be present in the films studied by Tsumura. Therefore, the Applicant respectfully submits that Tsumura is not applicable to the method recited in the present claims.

The Examiner first asserts that the invention of Tsumura is not relied upon for disclosing the scanning direction of the energy beam as the invention of Tanaka teaches a method and device for exposure control comprising scanning reticle stage in an x-direction using a light source (0129, lines 1-13), receiving reflected light (0131, lines 1-7) and measuring a distribution of luminance (0321, lines 1-8) wherein the measurement is performed in a direction perpendicular to the scanning direction of the light (0322, lines 1-5).

Additionally, while Applicant argues that "Tsumura discloses a method used to detect what seems to be random patterns (see Figure 10)" and "[a]s such, Tsumura's method cannot use the simplified analysis described in the claims, in particular, since no specific direction seems to be present in the films studied by Tsumura", such an argument does not provide any indication as to why Tsumura cannot be modified to explicitly indicate that the measurement is to be performed in a direction perpendicular to the scanning direction of the light to meet the claimed limitations. The Examiner asserts that the fact that Applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

As such, the Examiner maintains that it would have been obvious to one having ordinary skill in the art to modify the invention of Tsumura and Komuro to explicitly indicate that the measurement is to be performed in a direction perpendicular to the scanning direction of the light, as taught by Tanaka, because, as suggested by Tanaka, the combination would have improved the measurement of Tsumura and Komuro by canceling any irregularity of luminance measured in the scanning direction caused by the scanning itself (0322, lines 1-5).

Applicant argues:

> Further, the Official Action asserts that "the invention of Tsumura and Komuro does teach calculating average values of the luminance corresponding to the positions in the Y direction of a surface scanned by an energy beam" (page 9, Paper No. 20100719). The Applicant respectfully disagrees and traverses the

> assertions in the Official Action. The "energy beam,'" as recited in the present claims, is specifically an energy beam used for <u>processing</u> the semiconductor film, <u>i.e.</u>, "the semiconductor film having a crystallinity that has been improved by irradiating an energy beam." The "energy beam" recited in either Komuro or Tanaka is an energy beam used to perform <u>measurement</u> on the semiconductor film. The Applicant respectfully submits that a further combination with one or more of Tsumura, Lin, Ujihara and Tanabe does not cure the above-referenced deficiencies in Komura or Tanaka. In addition, for the same reason, a hypothetical combination with Tanaka does not cure the deficiencies of Tsumura and Komuro regarding performing a measurement <u>in a direction perpendicular to the scanning direction of the energy beam</u>.

The Examiner asserts that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Specifically, the Examiner asserts that the invention of Tsumura discloses a method for testing comprising irradiating a visible light on a surface of a semiconductor film (0027, lines 1-9), the semiconductor film having a crystallinity that has been improved by irradiating an energy beam (0063, lines 1-17); photo-transferring a scattered light of the irradiated visible light to form an image (0097, lines 1-16), analyzing regions of the image to discriminate regions of luminance (0091, lines 1-12) and comparing values of luminances with a reference value which is determined for a demanded performance of the semiconductor element in order to evaluate the crystallinity of the semiconductor film having the crystallinity that has been improved (0076, lines 1-12).

One having ordinary skill in the art would recognize that Tsumura already discloses an energy beam that is used for processing the semiconductor film by

providing a semiconductor film having a crystallinity that has been improved by irradiating the energy beam.

Therefore, while the invention of Tsumura does teach determining acceptance based on comparing values of luminances with a reference value which is determined for a demanded performance of the semiconductor element in order to evaluate the crystallinity of the semiconductor film having the crystallinity that has been improved wherein the determining is based on determining locations on the surface of the film on the basis of a histogram (0076, lines 1-12), and while Tsumura does specify that the beam source is set at an angle with respect to the perpendicular (0067, lines 1-7), Tsumura does not include the specifics on how the angle of the beam source is set.

Komuro then teaches a defect detecting apparatus comprising irradiating a visible light on a surface of a semiconductor (0061, lines 1-12) to produce a digital image by using a camera (0061, lines 4-8) to take a visible light dark field photograph (0087, lines 1-18), of a semiconductor film (0004, lines 1-5 and 0061, lines 4-8), wherein the visible light used for taking the dark field photograph of the semiconductor film is of an arbitrary wavelength provided it is visible (i.e. 600nm) (0188, lines 5-6) and calculating an average luminance of the digital image (0063, lines 1-20 and 0069, lines 1-11) by defining basic units consisting of m rows and n columns by dividing the digital image into n in the X direction and m in the Y direction in a predetermined analysis range (0092, lines 1-16 and 0149, lines 1-17), calculating/testing average values of luminances of the n basic units aligned in the X

direction per each of the m rows aligned in the Y direction (0063, lines 1-20 and 0069, lines 1-11), obtaining an approximate line (i.e. graph) from relations between the positions in the Y direction and the average values of the luminance corresponding to the positions in the Y direction (Figure 4), and comparing a fluctuation obtained from relations between the approximate line and the average values of the luminance with a reference value which is determined for a demanded beam performance of a semiconductor element that would comprise the semiconductor film (i.e. compare the fluctuation of the graph to a maximum allowed luminance reference value) (0063, lines 1-20, 0069, lines 1-11, 0088, lines 1-25, and Figure 4).

As such, the Examiner asserts that the combination of Tsumura and Komuro teaches calculating average values of the luminance based on the surface scanned by an energy beam that is used for processing the semiconductor film by providing a semiconductor film having a crystallinity that has been improved by irradiating the energy beam.

Applicant argues:

> Still further, the Applicant respectfully submits that the features of obtaining an approximate line from relations between positions in the Y direction and the average values of corrected saturations (or luminance, depending on the claims) corresponding to the positions in the Y direction are not, in fact, taught by Komuro. Komuro teaches obtaining graphs expressing luminance of diffracted light as a function of an angle of incidence of said light on a surface (<u>see, e.g.</u>, Figure 4, or lines 8-10 of the abstract). In contrast, the present claims recite calculating average values of luminances of n basic units aligned in the X direction per the m rows aligned in the Y direction; obtaining an approximate line from relations between positions in the Y direction and the average values of

luminances corresponding to the positions in the Y direction, where the X and Y directions are defined on a plane digital image. The Applicant respectfully submits that, considering the differences between the teachings of Komuro and the features of the present claims, it is unreasonable to consider the present claims as obvious over Komuro, either alone or in combination with one or more of Tsumura, Tanaka, Lin, Ujihara and Tanabe.

The Examiner disagrees with Applicant's interpretation of Komuro and instead maintains that Komuro teaches taking a visible light dark field photograph, specifically Komuro acquires a dark field image:

> In the first and second embodiments, a peak at the position of the nth-order light unclearly appears, as shown in FIG. 6, depending on the state of patterns on a semiconductor wafer 2, in a graph generated by an image analyzer 501 and indicating the relationship between the angle and the average luminance value of the diffracted light received at each inclination angle of an illuminating unit 3. The first-order light position of the diffracted light cannot be detected from this graph 20a, so a determination unit 502 cannot determine the first-order light of the diffracted light. In this case, a host computer 5 sets a predetermined angle (a preset reference inclination angle) prestored in a storage unit 503 and corresponding to the first-order light position, e.g., an angle at which flaws can be easily seen in a dark field image. This predetermined angle is any of an angle previously obtained by simulation, an inclination angle used in the previous defect detection, and an angle shifted about 5° to 10° from 45° at which a dark field image can be acquired. (0087, lines 1-18)

Komuro then teaches calculating an average luminance of the digital image by defining basic units consisting of m rows and n columns by dividing the digital image into n in the X direction and m in the Y direction in a predetermined analysis range, specifically Komuro inspects each row and column of an image and calculates the average value of the luminance values:

> The host computer 5 has an image analyzer 501, a determination unit 502, and a storage unit 503. This host computer 5 has a function of executing various

control operations necessary to set that inclination angle of the illuminating unit 3, which is best suited to sensing an image of the diffracted light. The image analyzer 501 receives information from the host computer 5, and generates a graph showing the relationship between the luminance value and the angle as shown in FIG. 4 (to be described later). The image analyzer 501 analyzes an image sensed by the image sensing unit 4, extracts defects such as film thickness variations, dust, and flaws on the semiconductor wafer 2, and causes the image display unit 6 to display information such as the types, numbers, positions, and areas of these defects. On the basis of this graph generated by the image analyzer 501 and showing the relationship between the luminance value and the angle, the determination unit 502 determines the position of the nth-order light, which is best suited to observation, of the diffracted light sensed by the image sensing unit 4. (0063, lines 1-20)

In step S4, the host computer 5 calculates the average value of the luminance values of the diffracted light received by the image sensing unit 4 at each inclination angle of the illuminating unit 3, and outputs to the image analyzer 501 these average luminance values as luminance values corresponding to the individual inclination angles. The image analyzer 501 performs image processing to generate a graph 20, as shown in FIG. 4, which indicates the relationship between the luminance value and the angle. The image analyzer 501 then supplies information based on the graph to the determination unit 502. (0069, lines 1-11)

In this state, an inspector operates an input unit 7 to move a cursor 27a displayed on the image display unit 6, thereby designating the column of a predetermined chip 26 on the wafer image 25 and also designating a predetermined region. If the inspector designates a region 261 corresponding to the pattern region 26a by a mouse pointer or the like on the cursor 27a which designates the pattern region 26a, the host computer 5 sets an illuminating light irradiation position 27 on the wafer image 25 such that, as shown in FIG. 7C, this irradiation position 27 crosses the region 261 corresponding to the pattern region 26a of each chip 26. If chips 26 are also present in the row direction, the size (vertical size) of one chip 26 from the irradiation position 27 is calculated, and another irradiation position 27 is so set as to cross a region 261 corresponding to a pattern region 26a of each chip 26. (0092, lines 1-16)

In this state, an inspector designates the column of a predetermined chip 26 on the wafer image 25 and also designates a predetermined region by using a cursor 27a from a menu screen (not shown) displayed on the personal computer 50. If the inspector designates a region 261 corresponding to the pattern region 26a by a mouse pointer or the like on the cursor 27a which designates the pattern region 26a, an irradiation position 27 on the wafer image 25 is so set, as shown in FIG. 16C, as to cross the region 261 corresponding to the pattern

> region 26a of each chip 26. If chips 26 are also present in the row direction, the size (vertical size) of one chip 26 from the irradiation position 27 is calculated, and another irradiation position 27 is so set as to cross a region 261 corresponding to a pattern region 26a of each chip 26. Assume that the inspector designates another region 281. In each chip 26, the regions 281 is present as in the region 261. (0149, lines 1-17)

Komuro further teaches calculating/testing average values of luminances of the n basic units aligned in the X direction per each of the m rows aligned in the Y direction, and obtaining an approximate line (i.e. graph) from relations between the positions in the Y direction and the average values of the luminance corresponding to the positions in the Y direction, specifically Komuro obtains a graph showing the relationship between the luminance value and the angle by calculating the average value of the luminance values of the diffracted light at each inclination angle of the illuminating unit:

> The host computer 5 has an image analyzer 501, a determination unit 502, and a storage unit 503. This host computer 5 has a function of executing various control operations necessary to set that inclination angle of the illuminating unit 3, which is best suited to sensing an image of the diffracted light. The image analyzer 501 receives information from the host computer 5, and generates a graph showing the relationship between the luminance value and the angle as shown in FIG. 4 (to be described later). The image analyzer 501 analyzes an image sensed by the image sensing unit 4, extracts defects such as film thickness variations, dust, and flaws on the semiconductor wafer 2, and causes the image display unit 6 to display information such as the types, numbers, positions, and areas of these defects. On the basis of this graph generated by the image analyzer 501 and showing the relationship between the luminance value and the angle, the determination unit 502 determines the position of the nth-order light, which is best suited to observation, of the diffracted light sensed by the image sensing unit 4. (0063, lines 1-20)
>
> In step S4, the host computer 5 calculates the average value of the luminance values of the diffracted light received by the image sensing unit 4 at each inclination angle of the illuminating unit 3, and outputs to the image analyzer 501

> these average luminance values as luminance values corresponding to the individual inclination angles. The image analyzer 501 performs image processing to generate a graph 20, as shown in FIG. 4, which indicates the relationship between the luminance value and the angle. The image analyzer 501 then supplies information based on the graph to the determination unit 502. (0069, lines 1-11)

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to Applicant's disclosure.

U.S. Patent No. 6,051,834 to Kakibayashi et al. teaches an electron microscope for analyzing a film surface using dark field photography.

U.S. Patent Application Publication No. 2002/0059896 to Yamaguchi et al. teaches an optical processing apparatus and optical processing method.

U.S. Patent Application Publication No. 2004/0203219 to Kasahara et al. teaches a laser apparatus and laser annealing method.

JP Patent Application Publication No. 2000-114174 to Hiroyuki teaches manufacture of semiconductor film, manufacture of thin-film transistor, active substrate and annealing equipment.

JP Patent Application Publication No. 2002-217107 to Wada et al. teaches method of evaluating polysilicon, thin film transistor manufacturing system and method of the same.

JP Patent Application Publication No. 2000-031229 to Terada teaches inspection method of semiconductor thin film and manufacture of semiconductor thin film by use thereof.

U.S. Patent No. 5,835,614 to Aoyama et al. teaches an image processing apparatus.

U.S. Patent No. 5,091,963 to Litt et al. teaches a method and apparatus for inspecting surfaces for contrast variations.

U.S. Patent No. 6,836,532 to Durst et al. teaches a diffraction system for biological crystal screening.

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrey R. West whose telephone number is

(571)272-2226. The examiner can normally be reached on Monday through Friday, 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eliseo Ramos-Feliciano can be reached on (571)272-7925. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jeffrey R. West/
Primary Examiner, Art Unit 2857

January 3, 2011